

## CLAIMS

What is claimed is:

1. An apparatus for controlling the operation of a fuel-fired appliance burner having a gas valve circuit for enabling the flow of gas to the burner, comprising:
  - a sensor capable of detecting the presence of flammable vapor;
  - a disconnection means in series with the gas valve circuit that enables the flow of gas; and
  - a switching means responsive to the sensor detecting the presence of flammable vapors, wherein the switching means switches an electrical current through the disconnection means in a manner such that the disconnection means opens the gas valve circuit to shut off the gas to the burner.
2. The apparatus of claim 1, wherein the disconnection means comprises a fuse device.
3. The apparatus of claim 2, wherein the sensor's resistance increases as the concentration of flammable vapors increases.
4. The apparatus of claim 3, where the sensor is incorporated in a voltage divider circuit.
5. The apparatus of claim 4, wherein the switching means comprises a field effect transistor that is gated on by the voltage divider circuit.
6. The apparatus of claim 5, wherein the voltage divider circuit comprises a resistor in series with the sensor, where an increase in resistance of the sensor will provide an on voltage to the gate for switching the Field Effect Transistor.
7. The apparatus of claim 6, wherein the Field Effect Transistor switches on to conduct current through fuse causing the fuse to blow when the sensor incorporated in the voltage divider circuit detects a predetermined flammable vapor concentration.
8. The apparatus of claim 7, wherein the predetermined flammable vapor concentration is about 50 percent of the lower flammability level.
9. The apparatus of claim 8, further comprising a battery for supplying voltage to the voltage divider circuit and the current switched to the fuse.
10. The apparatus of claim 9, further comprising a low battery level detection circuit for sensing a low battery voltage condition.

11. The control circuit of claim 10, wherein the apparatus further comprises an intermittent audible alarm means for alerting an occupant when the low battery level detection circuit detects a low battery condition.

12. The apparatus of claim 11, further comprising an audible alarm means for alerting the occupant when the sensor detects the predetermined flammable vapor concentration.

13. The apparatus of claim 1, wherein the disconnection means comprises a relay device.

14. A control circuit for shutting off a fuel-fired appliance burner having a thermocouple voltage that enables a gas valve solenoid to supply fuel to the appliance burner, the control circuit comprising:

- a power source for powering the control circuit,
- a fuse that is connected in series with the gas valve solenoid of the appliance in a manner such that the thermocouple voltage to the gas valve solenoid is interrupted when the fuse opens to cause the flow of gas to the burner to be shut off;
- a switching means for switching power from the power source to the fuse to cause the fuse to open;
- a sensor capable of detecting the presence of flammable vapor, where the sensor responsively changes in resistance as the concentration of flammable vapor changes;
- and
- a voltage divider circuit comprising a resistor and the sensor, the voltage divider circuit having a voltage potential between the resistor and the sensor that controls activation of the switching means, wherein the detection of flammable vapors by the sensor causes the voltage potential of the voltage divider to activate the switching means and open the fuse to cause the flow of gas to the burner to be shut-off.

15. The control circuit of claim 14, wherein the sensor's resistance increases as the concentration of flammable vapor increases.

16. The control circuit of claim 15, wherein the switching means comprises a field effect transistor that is gated on by the voltage potential of the voltage divider circuit.

17. The control circuit of claim 16, wherein the voltage potential of the voltage divider circuit gates the field effect transistor on when the sensor detects a predetermined flammable vapor concentration.

18. The control circuit of claim 17, wherein the predetermined flammable vapor concentration is about 50 percent of the lower flammability level.

19. The control circuit of claim 18, wherein the power source comprises at least one battery.

20. The control circuit of claim 19, wherein the control circuit further comprises a low battery level detection circuit for sensing a low battery voltage condition.

21. The control circuit of claim 20, wherein the control circuit further comprises an intermittent audible alarm means for alerting an occupant when the low battery level circuit detects a low battery condition.

22. The control circuit of claim 21, wherein the control circuit further comprises an audible alarm means for alerting the user of the gas appliance when the sensor detects the predetermined level of flammable vapor concentration.

23. A control circuit in connection with a thermocouple voltage source and a gas valve circuit of an appliance, for shutting off the flow of gas to discontinue operation of the appliance burner, the control circuit comprising:

- a power source for powering the control circuit,
- a fuse that is connected in series with the thermocouple voltage source and gas valve circuit, for interrupting the thermocouple voltage to the gas valve circuit to cause the flow of gas to the burner to be shut off;
- a switching means for switching power from the power source to the fuse to cause the fuse to open and interrupt the gas valve circuit;
- a sensor capable of detecting the presence of flammable vapor, where the sensor responsively changes in resistance as the concentration of flammable vapor changes;
- and
- a voltage divider circuit incorporating the sensor, wherein the detection of flammable vapors by the sensor causes a voltage potential in the voltage divider to activate the switching means and open the fuse to cause the flow of gas to the burner to be shut-off.

24. The control circuit of claim 23, wherein the sensor's resistance increases as the concentration of flammable vapor increases.

25. The control circuit of claim 24, wherein the switching means comprises a field effect transistor that is gated on by the voltage potential in the voltage divider circuit.

26. The control circuit of claim 25, wherein the voltage divider circuit gates the field effect transistor on when the sensor detects a predetermined flammable vapor concentration.
27. The control circuit of claim 26, wherein the predetermined flammable vapor concentration is about 50 percent of the lower flammability level.
28. The control circuit of claim 27, wherein the power source comprises at least one battery.
29. The control circuit of claim 28, wherein the power source comprises exactly two batteries.
30. The control circuit of claim 29, wherein the control circuit further comprises a low battery level detection circuit for sensing a low battery voltage condition.
31. The control circuit of claim 30, wherein the control circuit further comprises an intermittent audible alarm means for alerting an occupant when the low battery level circuit detects a low battery condition.
32. The control circuit of claim 31, wherein the control circuit further comprises an audible alarm means for alerting the user of the gas appliance when the sensor detects the predetermined flammable vapor concentration.
33. The control circuit of claim 24, wherein the switching means comprises a relay.
34. A method of controlling the operation of a gas appliance having a thermocouple voltage source and gas valve circuit for enabling gas flow to a burner, a fuse in series with the gas valve circuit, a switch, a battery, and a flammable vapor sensor, the method comprising the steps of:  
    sensing the presence of a predetermined flammable vapor concentration with a variable resistance sensor;  
    responsively actuating the switch to supply battery current to the fuse; and  
    the fuse responsively blowing to interrupt the thermocouple voltage to the gas valve circuit such that the gas flow to the burner is shut off until the appliance can be serviced.
35. The method of claim 34, further comprising the step of sounding an audible alarm when the switch is actuated, for alerting an occupant of the predetermined flammable vapor concentration.
36. The method of claim 35, further comprising the steps of sensing a low battery voltage, and sounding an intermittent audible alarm for alerting an occupant of the low battery condition.